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U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-001

Dresden Nuclear Power Station, Units 2 and 3
Facility Operating License Nos. DPR-19 and DPR-25
NRC Docket No. 50-237 and 50-249

Quad Cities Nuclear Power Station, Units 1 and 2
Facility Operating License Nos. DPR-29 and DPR-30
NRC Docket Nos. 50-254 and 50-265

Subject: Additional Information for the Review of the License Renewal Applications for Dresden Nuclear Power Station, Units 2 and 3 and Quad Cities Nuclear Power Station, Units 1 and 2

References:
(1) Letter from J. A. Benjamin (Exelon Generation Company, LLC) to U. S. NRC, "Application for Renewed Operating Licenses," dated January 3, 2003

(2) Letter from Tae Kim (U. S. NRC) to John Skolds (Exelon Generation Company, LLC), "Supplemental Request for Additional Information for the Review of the Dresden Nuclear Power Station, Units 2 and 3, and Quad Cities Nuclear Power Station, Units 1 and 2, License Renewal Application," dated October 27, 2003

Exelon Generation Company, LLC (EGC) is submitting the additional information requested in Reference 2 and in email requests sent by Tae Kim (NRC) to EGC on October 14, 23, and 24, 2003. This additional information provides a response to questions regarding the Electrical, Fire Protection, and Aging Management Programs sections of Reference 1 to support the NRC review. EGC responses to requests for additional information for RAI B.1.25, B.2.2-1, 3.6-4 and 3.6-7 will be submitted in a later correspondence.

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Should you have any questions, please contact Al Fulvio at 610-765-5936.

I declare under penalty of perjury that the foregoing is true and correct.

Respectfully,

11/20/03
Executed on

Patrick R. Simpson
Manager – Licensing

Attachments:
Attachment 1: Response to Request for Additional Information – Electrical
Attachment 2: Response to Request for Additional Information – Fire Protection
Attachment 3: Response to Request for Additional Information – Aging Management Programs

cc: Regional Administrator – NRC Region III
NRC Senior Resident Inspector – Quad Cities Nuclear Power Station
NRC Senior Resident Inspector – Dresden Nuclear Power Station
Illinois Emergency Management Agency

Attachment 1

Response to Request for Additional Information – Electrical

RAI 2.5-2 Supplemental Information Request

(a) Paragraph 2.5.1.1, "Cables and Connections," of the License Renewal Application states in part that "as appropriate, electrical cables and connections were excluded from aging management if they were identified as feeding an electrical component that performed no license renewal intended function. Please clarify whether your aging management review for cables have included in scope those cables that "performed no license renewal intended function," but share same cable trays/raceways with cables that do perform license renewal intended function. If those cables were excluded, then provide justification for exclusion from aging management review; otherwise, submit an aging management review for the subject cables.

(b) It appears that certain electrical components, such as, switchyard bus, high voltage transmission conductor connections, and uninsulated ground conductors were excluded from the scope of license renewal aging management review. Provide justification for excluding these components from aging management review; otherwise, submit an aging management review for the subject components.

Response

(a) Cables that perform no license renewal intended function and share the same cable trays/raceways with cables that do perform license renewal function are included in the scope of license renewal. Because these cables share the same trays/raceways, Exelon included all of the cables within the scope of license renewal and will manage these cables under aging management program B.1.33, Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements. This aging management program is consistent with NUREG 1801 program XI.E1, Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements.

The only cables that were excluded from the scope of license renewal are the medium voltage cables to the Quad Cities circulating water pump motors and the cables within the Radwaste Building. The circulating water pump motor cables are routed in dedicated raceways that do not contain cables performing license renewal functions. The Radwaste Building does not contain any electrical components within the scope of license renewal. As such, all of the cables contained in the trays/raceways found in the Radwaste Building are excluded from the scope of license renewal and do not require aging management.

(b) The following response addresses:

i. Switchyard buses
ii. High voltage transmission conductor connections
iii. Electrical grounding system

i. The switchyard buses are in the scope of license renewal. However, NUREG-1801 does not address aging management for Bus Bar and Connections. As stated in the response to RAI 3.6-7, the switchyard buses are constructed of aluminum and are exposed to an outdoor environment. . The plant outdoor environment is not subject to heavy industry air pollution or saline environment and is not conducive to promoting aging degradation. As such, switchyard buses do not require aging management.

ii. The high voltage transmission conductor connections are covered as part the high voltage transmission conductors. The transmission conductor connections are aluminum compression connectors. EPRI 1003057, License Renewal Electrical Handbook, discusses the aging of high voltage transmission conductors, which includes connections, and concludes that the potential aging mechanism of corrosion does not produce any significant effects that would be of a concern for their intended function. Regarding high voltage transmission conductor strength, tests performed by Ontario Hydroelectric showed a 30% loss of composite conductor strength of an 80-year-old ACSR conductor due to corrosion. Using the example of a 4/0 ACSR conductor, EPRI 1003057 shows the ultimate strength and the NESC heavy load tension requirements of 4/0 ACSR are 8350 lbs. and 2761 lbs. respectively. The margin between the NESC Heavy Load and the ultimate strength is 5589 lb.; i.e., there is a 67% of ultimate strength margin. The Ontario Hydroelectric study showed a 30% loss of composite conductor strength in an 80-year-old conductor. In the case of the 4/0 ACSR transmission conductors, a 30% loss of ultimate strength would mean that there would still be a 37% ultimate strength margin between what is required by the NESC and the actual conductor strength.

There is a set percentage of composite conductor strength established at which a transmission conductor is replaced. The National Electrical Safety Code (NESC) requires that tension on installed conductors be limited to a maximum of 60% of the ultimate conductor strength. The NESC also sets the maximum tension a conductor must be designed to withstand under various load requirements, which includes consideration of ice, wind and temperature. The Exelon (ComEd) design and installation practice limits the tension in the conductors such that it will not exceed a maximum of 50% of its rated tensile strength. Therefore, for a typical transmission conductor, there is ample design margin to offset the loss of strength due to corrosion and maintain the transmission conductor intended function through the extended period of operation.

With respect to corrosion of steel core caused by loss of zinc coating or aluminum strand pitting corrosion, this is a very slow acting aging effect that is even slower for rural areas with generally less suspended particles and SO_2 concentrations in the air than urban or industrial areas. The transmission conductors at Dresden and Quad Cities do not see air particulates or contaminants as seen in urban or heavy industrial areas. Therefore, corrosion is not a credible aging mechanism for the intended function of Dresden and Quad Cities transmission conductors.

EPRI 1003057 also discusses the aging of high voltage transmission conductors and concludes that the potential aging mechanism of vibration does not produce any significant effects that would be of a concern for their intended function. Regarding wind loading induced vibration, wind loading is considered in the design and installation. Aging effect of loss of material and fatigue that could be caused by transmission conductor vibration or sway are not applicable in that they would not cause a loss of intended function for the extended period of operation. Experience has shown that the transmission conductors do not normally swing significantly. When they do swing due to a substantial wind, they do not continue to swing for very long once the wind has subsided. Wind loading that can cause a transmission line to sway is considered in the

design and installation. Therefore, wind loading induced vibration and fatigue are not credible aging mechanisms, and will not cause a loss of intended function of the conductors at Dresden and Quad Cities.

iii. The electrical grounding system is not included within the scope of license renewal. See Table 2.2-3 Electrical and Instrumentation and Controls Systems Scoping Results. The electrical grounding system is not safety related, is not credited in any plant current licensing bases, and will not prevent satisfactory accomplishment of any of the safety-related functions identified in 10 CFR 54.4(a)(1)(i),(ii), or (iii). Based upon the plant's conformance with single failure criteria, there is no credible uninsulated ground conductor failure mode or mechanism that would prevent satisfactory accomplishment of any of the safety-related functions identified in 10 CFR 54.4(a)(1)(i),(ii), or (iii). As such, the passive electrical commodity of uninsulated ground conductor is not within the scope of license renewal.

RAI 3.6-1 Supplemental Information Request

In response to RAI 3.6-1, the applicant on October 3, 2003, stated that it will continue to include fuse holders in an aging management program consistent with NUREG 1801 XI.E1. Additionally, it will follow the guidance contained in ISG-5 dated March 4, 2003 and identify those fuse holders that are not part of a larger assembly but support safety-related and non-safety related functions in which the failure of a fuse precludes a safety function from being accomplished. Any fuses satisfying this criterion will be evaluated against the stressors listed in ISG-5 and an aging management program will be developed if the aging evaluation determines that one is necessary. These fuses will be identified, the evaluation against the stressors completed, and the actions identified in the aging management program completed the first time, if necessary, prior to entering the period of extended operation. On the basis of its review, the staff finds that its concern is not resolved. The staff can not determine whether the applicant will provide an AMP to manage the aging effects of the metallic portion of the fuse holders. If the applicant chooses to perform the evaluation against the stressors identified in ISG-5, the staff wants to review the evaluation for acceptability. Based on this the staff finds this to be an open item.

Response

In the original response to RAI 3.6-1, Exelon stated that they would continue to include fuse holders in an aging management program consistent with NUREG 1801 XI.E1. Additionally, Exelon would follow the guidance contained in ISG-5 and identify those fuse holders that are not part of a larger assembly but support safety-related and non-safety related functions in which the failure of a fuse precludes a safety function from being accomplished. Any fuses satisfying this criterion would be evaluated against the stressors listed in ISG-5 and an aging management program would be developed if the aging evaluation determined that one was necessary. Exelon has completed the scoping and aging management review of fuse holders in compliance with the guidance contained in ISG-5. The following provides a description of the methodology utilized and the results for both sites.

Methodology

Exelon compiled a list of all fuses from the controlled equipment data base (Passport) at each site. Using this fuse list, the non safety related fuse holders (fuse clip and blocks) whose failure could not preclude a safety function from being accomplished were removed from the population.

The remaining fuses were then further evaluated against the criteria found in ISG-5 in the following way. Every fuse at each site contains a unique equipment identification number. Most often, the fuse identification number contains the panel number in which the fuse is located. Using the unique equipment numbers for each fuse, those fuses that were part of a larger assembly such as switchgear or main control room panels were removed from the population. In those cases where the fuse identification number did not specify the fuse location, a plant walk down or drawing review was performed to identify and remove those fuses that were part of a larger assembly.

When complete, a total of 724 fuse holders at Quad Cities and 708 fuse holders at Dresden were in the population to be analyzed for aging management. The 708 fuse holders at Dresden are located in 17 different panels shown in Table 1 below. The 724 fuse holders at Quad Cities are located in 25 different panels shown in Table 2 below. The panel numbers, locations in the plant, and service description for each group of fuse holders requiring aging analysis are listed in the tables. All of the fuse and fuse holders at Dresden provide 125 VDC power to the Control Rod Drive SCRAM solenoids. The majority of the fuse and fuse holders shown in Table 2 at Quad Cities provide 125 VDC power to the Control Rod Drive SCRAM solenoids. The remaining fuses and fuse holders at Quad Cities provide alternate 125VDC power to various 4KV switchgear and are part of the fire protection safe shutdown circuitry.

Table 1

List of Dresden Station Panels Containing Fuse Blocks Requiring Evaluation

Panel	Location	Service
2-2202-22A	Reactor Building/ Elevation 517'	SCRAM Solenoid Fuse Panel
2-2202-22B	Reactor Building/ Elevation 517'	SCRAM Solenoid Fuse Panel
2-2202-22C	Reactor Building/ Elevation 517'	SCRAM Solenoid Fuse Panel
2-2202-22D	Reactor Building/ Elevation 517'	SCRAM Solenoid Fuse Panel
2-2202-22E	Reactor Building/ Elevation 517'	SCRAM Solenoid Fuse Panel
2-2202-22F	Reactor Building/ Elevation 517'	SCRAM Solenoid Fuse Panel
2-2202-22G	Reactor Building/ Elevation 517'	SCRAM Solenoid Fuse Panel
2-2202-22H	Reactor Building/ Elevation 517'	SCRAM Solenoid Fuse Panel

3-2203-22A	Reactor Building/ Elevation 517'	SCRAM Solenoid Fuse Panel
3-2203-22B	Reactor Building/ Elevation 517'	SCRAM Solenoid Fuse Panel
3-2203-22B	Reactor Building/ Elevation 517'	SCRAM Solenoid Fuse Panel
3-2203-22C	Reactor Building/ Elevation 517'	SCRAM Solenoid Fuse Panel
3-2203-22D	Reactor Building/ Elevation 517'	SCRAM Solenoid Fuse Panel
3-2203-22E	Reactor Building/ Elevation 517'	SCRAM Solenoid Fuse Panel
3-2203-22F	Reactor Building/ Elevation 517'	SCRAM Solenoid Fuse Panel
3-2203-22G	Reactor Building/ Elevation 517'	SCRAM Solenoid Fuse Panel
3-2203-22H	Reactor Building/ Elevation 517'	SCRAM Solenoid Fuse Panel

Table 2

List of Quad Cities Panels Containing Fuse Blocks Requiring Evaluation

Panel	Location	Service
1-2201-22A	Reactor Building/ Elevation 595'	SCRAM Solenoid Fuse Panel
1-2201-22B	Reactor Building/ Elevation 595'	SCRAM Solenoid Fuse Panel
1-2201-22C	Reactor Building/ Elevation 595'	SCRAM Solenoid Fuse Panel
1-2201-22D	Reactor Building/	SCRAM Solenoid Fuse Panel
1-2201-22E	Reactor Building/ Elevation 595'	SCRAM Solenoid Fuse Panel
1-2201-22F	Reactor Building/ Elevation 595'	SCRAM Solenoid Fuse Panel
1-2201-22G	Reactor Building/ Elevation 595'	SCRAM Solenoid Fuse Panel
1-2201-22H	Reactor Building/ Elevation 595'	SCRAM Solenoid Fuse Panel
3-2203-22A	Reactor Building/ Elevation 595'	SCRAM Solenoid Fuse Panel
2-2202-22B	Reactor Building/ Elevation 595'	SCRAM Solenoid Fuse Panel
2-2202-22B	Reactor Building/ Elevation 595'	SCRAM Solenoid Fuse Panel

2-2202-22C	Reactor Building/ Elevation 595'	SCRAM Solenoid Fuse Panel
2-2202-22D	Reactor Building/ Elevation 595'	SCRAM Solenoid Fuse Panel
2-2202-22E	Reactor Building/ Elevation 595'	SCRAM Solenoid Fuse Panel
2-2202-22F	Reactor Building/ Elevation 595'	SCRAM Solenoid Fuse Panel
2-2202-22G	Reactor Building/ Elevation 595'	SCRAM Solenoid Fuse Panel
2-2202-22H	Reactor Building/ Elevation 595'	SCRAM Solenoid Fuse Panel
1-0030-JB330-F1	Turbine Building/ Elevation 639'	FUSE F1 FOR ALTERNATE 125VDC FEED TO SWGR 13-1 CUB 2
1-0030-JB330-F2	Turbine Building Elevation 639'	FUSE F2 FOR ALTERNATE 125VDC FEED TO SWGR 13-1 CUB 2
1-0030-JB331-F1	Turbine Building/ Elevation 639'	FUSE F1 FOR ALTERNATE 125VDC FEED TO SWGR 14-1 CUB 9
1-0030-JB331-F2	Turbine Building/ Elevation 639'	FUSE F2 FOR ALTERNATE 125VDC FEED TO SWGR 14-1 CUB 9
2-0030-JB330-F1	Turbine Building/ Elevation 639'	FUSE FOR ALTERNATE 125VDC FEED TO SWGR 23-1 CUB 9
2-0030-JB330-F2	Turbine Building/ Elevation 639'	FUSE F2 FOR ALTERNATE 125VDC FEED TO SWGR 23-1 CUB 9
2-0030-JB331-F1	Turbine Building/ Elevation 639'	FUSE F1 FOR ALTERNATE 125VDC FEED TO SWGR 24-1 CUB 2
2-0030-JB331-F2	Turbine Building/ Elevation 639'	FUSE F2 FOR ALTERNATE 125VDC FEED TO SWGR 24-1 CUB 2

Aging Analysis

The stressors referenced in ISG-5 were evaluated for each of fuse holders contained in the panels listed in Tables 1 and 2 above. The aging evaluation results for each stressor are described below.

Moisture:

As stated in DOE Cable Aging Management Guideline (SAND 0944), Section 3.7.2.1.3, 3% of all low-voltage metal connector failures were identified as being caused by moisture intrusion. In each case, the source of moisture was precipitation. Based on the total number of reported connector failures in the DOE Cable AMG, moisture intrusion accounted for only 10 failures in all of the operating plants in the United States. The fuse holders at Dresden and Quad Cities Stations that require an AMR are protected from external sources of moisture by two barriers. For the first barrier, the panels in which the subject fuse holders are installed are located in rooms inside the reactor and turbine buildings, which do not see high relative humidity conditions. Based on plant walk downs, these panels are not located in areas which experience adverse localized

temperature or humidity. These areas are protected from weather variations and are not subject to any significant temperature variations. As a second barrier, the fuse holders are located in closed enclosures. With regard to internal moisture (i.e., formation of condensation), a walk down revealed no signs of moisture/humidity in the area or any signs of moisture within the enclosures.

Chemical Contamination

For chemical contamination, the fuse holders are protected, as described above, by their location and enclosure. There are no sources of chemicals in the area or vicinity of the fuses and the plant walk down inspections confirmed this.

Oxidation and Corrosion

Fuse clips are made of copper or copper alloy plated with a corrosion resistant coating material to protect the base metal from oxidation and provide for low electrical resistance. The fuses experience no appreciable change in operating environment and are not located near heavy industrial or oceanic environments. Furthermore, the fuse holders evaluated are not near any humid areas. Based upon recent inspections of the Bussmann fuse blocks performed in September, 2003, the surface condition of the fuse clips show no signs of corrosion and still retain their metal surface. Additionally, there was no evidence or trace of moisture. For these reasons, oxidation and corrosion are not applicable stressors.

Mechanical Stresses, Electrical Transients, Thermal Cycling, Fatigue

Mechanical stress due to forces associated with electrical faults and transients are mitigated by the fast action of circuit protective devices at high currents. However, mechanical stress due to electrical faults is not considered a credible aging mechanism since such faults are infrequent and random in nature. The station's corrective action reporting process is used to document adverse conditions and provides corrective actions associated with electrical fault and transients that cause the actuation of circuit protective devices.

The Quad Cities fuse holders associated with alternate feeds to switchgear (used during fire protection safe shutdown) are normally de-energized and do not experience frequent cycling. As such, they do not experience enough heat to damage the fuse blocks and connections.

The Dresden and Quad Cities fuse holder SCRAM solenoids stay energized during normal operation and also do not experience frequent cycling. The loading seen by these fuses are well below 60%. A 60% loading is identified as a critical value in NUREG-1760 for fuses as generating enough heat to damage the fuse blocks and connections. The SCRAM solenoids draw about 15 watts and the fuses are rated for 3 amps. Therefore, these fuses are lightly loaded. Inspection of a few samples did not reveal any age related degradation and the fuse clips did not exhibit any signs of degradation.

Vibration is induced in fuse holders by the operation of external equipment, such as compressors, fans, and pumps. Since there are no direct sources of vibration for the fuse holder panels, and the panels are mounted separately on their own support structure on concrete walls, vibration is not an applicable aging mechanism.

By design and their location, the fuse holders are not subject to aging effects associated with thermal cycling. The SCRAM solenoid fuses are very lightly loaded and will experience very insignificant temperature rise.

Wear/fatigue aging mechanism is caused due to repeated insertion and removal of fuses. The fuses evaluated are not subject to frequent manipulations. When these circuits need to be de-energized, power is removed at the safety related power supplies. When manipulated, an inspection is performed that would identify any abnormal indication such as loose or corroded fuse clips.

Fatigue may also be caused by frequent cycling of fuses when subject to significant loading, which would cause the clips to expand and contract and experience fatigue failure. However, the subject fuses do not experience operational cycling during normal service due to the fact that they are lightly loaded, and therefore this is not a concern.

Conclusion

Based on the aging evaluations of the stressors identified in ISG-5, evaluations presented in NUREG-1760, and the operating service conditions of the fuses in scope of this evaluation, no stressors are identified for these fuse blocks/clips that would require aging management.

RAI 3.6-2 Supplemental Information Request

In response to RAI 3.6-2, at Quad Cities all but three electrical penetrations are part of the station EQ program. These three penetrations serve circuits (such as drywell booster fans and main steam line vibration monitoring instrumentation) that do not perform any electrical intended function. The staff is concerned about a leak in penetration due to electrical fault on these circuits. Please provide details about these circuits (i.e., energized during shut down only and power supply is disconnected during plant operation, etc.). Discuss why the aging of the insulation do not have any effect on the penetration damage curve so that penetration seal integrity is maintained as a part of containment pressure boundary.

Response

The three electrical penetrations at Quad Cities that are not part of the station EQ program are included within the scope of license renewal. However, they only perform a pressure boundary function for the primary containment and do not have any electrical related intended functions. The pressure boundary function for these penetrations is managed under ASME Section XI, Subsection IWE (B.1.26) and 10 CFR Part 50, Appendix J (B.1.28).

Penetration #	Load
1-X102B	Drywell 1 Vent Booster Fan (Ref 4E-1670G) Junction Box IRB-262 Vibration Instrumentation
2-X100A	Vibration Instrumentation

Vibration Instrumentation

2-X105A	Drywell 2 Vent Booster Fan (Ref 4E-2670H) Junction Box IRB-180 Vibration Instrumentation

The Drywell Vent Booster Fans are continuously energized during plant operations. The circuit for these fans is protected by redundant 100 amp in-scope circuit breakers. The cables from the MCC to the penetrations and from the penetrations to the fans are in-scope and managed by aging management program B.1.33 Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements. The Conax penetration feed-through-modules are # 2 AWG solid copper conductors insulated with polyimide film. The circuits are designed such that the 100 amp breakers are coordinated to clear all fault currents before the short circuit capacity of the # 2 AWG feed-through-modules is exceeded thus preventing damage to the penetration seal integrity. There are no credible aging effects that reduce the short circuit capacity of solid copper conductors. Short circuit capacity is based on the circular mills of the copper conductor.

The vibration Instrumentation circuits are low voltage, milliamp circuits protected by fuses. Fault currents are in the milliamp range and not severe enough to cause damage to the # 18 AWG feed-through-modules. The cables for these instrumentation circuits are in-scope and managed by aging management program B.1.33 Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements.

The design of the Conax penetration module is a stainless steel tube that is sealed at both ends with polysulfone. Solid copper polymide film insulated conductors passes though the stainless steel tube and are molded into the polsulfone seal at both ends to provide a leak proof seal. A visual inspection of the exposed polymide film insulation will not provide any indication of the leak tightness of the penetration because the insulation cannot be visually inspected once it passes into the polsulfone seal. The aging management programs that are used to manage the aging of the pressure boundary function are Containment ISI (B.1.26) and Containment leak rate test (B.1.28).

Identical Conax EQ penetrations are installed at the Dresden station. The Dresden Conax EQ penetrations are qualified for 60 years of normal and one-year accident/post accident conditions in accordance with IEEE 323-1983 requirements and NUREG-0588, Category I. The Quad Cities Conax penetrations experience similar environmental conditions as the qualified Dresden penetrations.

In summary:

a) Electrical faults are mitigated by the circuit protection devices prior to damaging the feed through conductor or insulation.
b) Visual inspection of the pigtail insulation provides no indication of the integrity of the seal.
c) These penetration do not perform an electrical intended function that supports 10 CFR 54.4 (a) (1) (i), (ii), (iii) (2) or (3).
d) The pressure boundary function is managed by aging management programs Containment ISI (B.1.26) and Containment leak rate test (B.1.28).
e) Identical Conax EQ penetrations are installed at Dresden and are qualified for 60 years.

Therefore, using aging management programs Containment ISI (B.1.26) and Containment leak rate test (B.1.28) to manage the aging effects of the penetrations provides reasonable issuance that the License Renewal intended function of the Quad Cities Non-EQ penetrations will be maintained during the prior of extended operation.

RAI 3.6-3 Supplemental Information Request

RAI 3.6-3 requested information regarding the replacement cables. The staff finds that the applicant did not identify the type of the replacement cables at Dresden. As a result, the staff considers this to be an open item. The staff concludes that an aging management program is needed to manage the aging of inaccessible medium-voltage cables susceptible to wetting. The staff is concerned why no other cable is subjected to significant moisture and voltage. Discuss diesel generator cooling water supply and other heat exchanger cooling water supply.

Response

Exelon has reevaluated its position regarding to the replacement of the five medium-voltage cables at Dresden. A review of the industry experience contained within EPRI TR 103834-P1-2, Effects of Moisture on the Life of Power Plant Cables and SAND96-0344, Aging Management Guideline for Commercial Nuclear Power Plants has determined that butyl rubber insulated medium-voltage cable has not experienced failure due to water treeing. Based on the lack of adverse industry experience and more than 30 years of continuous operating experience, Exelon believes that these cable will perform their intended functions for the period of extended operation. As such, Exelon does not intend to replace the cables as stated in section 3.6.1.2.2 of the Dresden and Quad Cities License Renewal Application. Rather, Exelon will manage these cables in accordance with NUREG-1801 XI.E3 aging management program. The following is a new LRA section B.1.38 and A.1.38 that describes this new aging management program for Inaccessible Medium-Voltage Cables not Subject to 10 CFR 50.49 Environmental Qualification Requirements.

Exelon has reviewed all of the in-scope inaccessible medium-voltage cables that are installed in underground duct runs and as stated in the response to RAI 3.6.3 there are only five inaccessible in-scope medium voltage cables at Dresden that are exposed to significant moisture and that are energized more than twenty-five percent of the time. The diesel generator cooling water supply pump motors are 480 V ac, not 4160 V ac. For this reason, they are not considered medium-voltage cables. Additionally, the electrical loads referenced in Table 8.3-2 of the Quad Cities UFSAR represent the major diesel generator loading for both automatic and manual operation on loss of offsite power (LOOP). The loads listed in Table 8.3-2 are not required to achieve safe shutdown of a reactor in the event of a LOOP. LRA Section 2.3.3.16 Service Water system shows that for Quad Cities the Service Water system is only in-scope, as specified in 10 CFR 54.4(a)(2), to preclude adverse effects on safety-related SSC's and for structural support. The Quad Cities Service Water system does not perform any intended function within the scope of License Renewal as specified in 10 CFR 54.4(a) (1) or (3). Therefore, the medium-voltage cable feeds to the Quad Cities service water pumps are not within the scope of License Renewal.

A.1.38 Inaccessible Medium-Voltage Cables Not Subject To 10 CFR 50.49 Environmental Qualification Requirements (Dresden Only)

Five inaccessible medium-voltage cables not subject to 10 CFR 50.49 environmental qualification requirements that feed the Dresden service water pumps will be managed by this program. These cables may at times be exposed to moisture and are subjected to system voltage for more than 25% of the time. The cables will be tested at least once every 10 years to provide an indication of the condition of the conductor insulation. The first tests will be completed prior to the period of extended operation. The cables will be tested with a proven test for detecting deterioration of the insulation system due to wetting, such as power factor, partial discharge, or polarization index, as described in EPRI TR-103834-P1-2, or other testing that is state-of-the-art at the time the test is performed. The end of the duct bank at the crib house will be inspected annually to verify that the crib house end of the duct run is not plugged with debris.

B.1.38 Inaccessible Medium-Voltage Cables Not Subject To 10 CFR 50.49 Environmental Qualification Requirements

Description

The aging management program for inaccessible medium-voltage cables not subject to 10 CFR 50.49 environmental qualification requirements manages medium-voltage cables within the scope of License Renewal that are exposed to significant moisture simultaneously with significant voltage.

Significant moisture is defined as periodic exposures to moisture that last more than a few days (e.g., cable in standing water). Periodic exposures to moisture that last less than a few days (i.e., normal rain and drain) are not significant. Significant voltage exposure is defined as being subjected to system voltage for more than twenty-five percent of the time.

This aging management program applies to the Dresden Station only. The Dresden Station has five butyl rubber insulated inaccessible medium-voltage cables within the scope of this program. These cables are routed in underground duct banks that are at times exposed to significant moisture and are energized more than twenty-five percent of the time. The Quad Cities Station has no medium-voltage cables that perform intended functions which demonstrate compliance with 10 CFR 54.4 that are routed in underground duct banks.

This program manages the presence of water in the duct banks through the use of an annual inspection of the ducts where they exit into the crib house. Based on previous experience, moisture is expected to be present inside the duct bank that runs to the crib house. This duct bank is a continuous run without manholes. The ducts are sloped toward the crib house and during wet seasons, water drains from the ducts. As part of this aging management program, the ducts will be inspected annually to verify that the crib house end of the duct run is not plugged with debris.

Additionally these cables will be tested to provide an indication of the condition of the conductor insulation. The specific type of test performed will be determined prior to the initial test. The cables will be tested with a proven test for detecting deterioration of the insulation system due to wetting, such as power factor, partial discharge, or polarization index, as described in EPRI TR-

103834-P1-2, or other testing that is state-of-the-art at the time the test is performed. This test will be performed at least once every 10 years with the first test being performed prior to the period of the extend operation.

NUREG-1801 Consistency

The aging management program for inaccessible medium-voltage cables not subject to 10 CFR 50.49 environmental qualification requirements is a new program. The program is scheduled for implementation prior to the period of extended operation. Program activities are consistent with the ten elements of aging program XI.E3, "Inaccessible Medium-Voltage Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements" specified in NUREG-1801.

Operating Experience

This program is new. Therefore, no programmatic operating experience is available.

Conclusion

The aging management program for inaccessible medium-voltage cables not subject to 10 CFR 50.49 environmental qualification requirements provides reasonable assurance that aging effects are adequately managed so that the intended functions of these types of cables are maintained during the period of extended operation.

A comparison of the NUREG-1801 XI.E3 aging management program against Exelon aging management program, (B.1.38) Inaccessible Medium-Voltage Cables Not Subject To 10 CFR 50.49 Environmental Qualification Requirements, is provided below.

(B.1.38) Inaccessible Medium-Voltage Cables Not Subject To 10 CFR 50.49 Environmental Qualification Requirements

	XI.E3, Inaccessible Medium-Voltage Cables Not Subject To 10 CFR 50.49 Environmental Qualification Requirements	(B.1.38) Inaccessible Medium-Voltage Cables Not Subject To 10 CFR 50.49 Environmental Qualification Requirements		
Program Elements	**NUREG-1801 Description**	**Dresden-Quad Cities Basis**	**GALL Exception**	**Comments**
Program Description	Most electrical cables in nuclear power plants are located in dry environments. However, some cables may be exposed to condensation and wetting in inaccessible locations, such as conduits, cable trenches, cable troughs, duct banks, underground vaults or direct buried installations. When an energized medium-voltage cable is exposed to wet conditions for which it is not designed, water treeing or a decrease in the dielectric strength of the conductor insulation can occur. This can potentially lead to electrical failure. The purpose of the aging management program described herein is to provide reasonable assurance that the intended functions of inaccessible medium-voltage cables that are not subject to the environmental qualification requirements of 10 CFR 50.49 and are exposed to adverse localized environments caused by moisture while energized will be maintained consistent with the current licensing basis through the period of extended operation. An adverse localized environment is a condition in a limited plant area that is significantly more severe than the specified service environment for the cable. An adverse variation in environment is significant if it could appreciably increase the rate of aging of a component or have an immediate adverse effect on operability. This program considers the technical information and guidance provided in NUREG/CR-5643, IEEE Std. P1205, SAND96-0344, and EPRI TR-109619. In this aging management program periodic actions are taken to prevent cables from being exposed to significant moisture, such as inspecting for water collection in cable manholes and conduit, and draining water, as needed. In-scope, medium-voltage cables exposed to significant moisture and significant voltage are tested to provide an indication of the condition of the conductor insulation. The specific type of test performed will be determined prior to the initial test, and is to be a proven test for detecting deterioration of the insulation system due to wetting, such as power factor, partial discharge, or polarization index, as described in EPRI TR-103834-P1-2, or other testing that is state-of-the-art at the time the test is performed. As stated in NUREG/CR-5643, "The major concern with cables is the performance of aged cable when it is exposed to accident conditions." The statement of considerations for the final license renewal rule (60 Fed. Reg. 22477) states, "The major concern is that failures of deteriorated cable systems (cables, connections, and penetrations) might be induced during accident conditions." Since they are not subject to the environmental qualification requirements of 10 CFR 50.49, the electrical cables covered by	All medium-voltage cables, that are not subject to the environmental requirements of 10 CFR 50.49, that are continuously energized and routed in underground ducts exposed to significant moisture conditions have been reviewed. For Dresden Station, the cables within the scope of this program are five butyl rubber insulated inaccessible medium-voltage cables that feed the Dresden service water pumps. These cables routed in underground duct banks that are at times exposed to significant moisture and are energized more than twenty-five percent of the time. The cable numbers for these cables are 20659, 20766, 20773, 30659 and 30766. Quad Cities Station has no medium-voltage cables that perform intended functions which demonstrate compliance with 10 CFR 54.4 that are routed in underground duct banks The purpose of this aging management program is to provide reasonable assurance that the intended function of the five inaccessible medium-voltage cables, which are not subject to the environmental qualification requirements of 10 CFR 50.49, that supply power to the Dresden service water pumps are maintained consistent with the current licensing basis through the period of extended operation. For Dresden, adverse conditions are expected to be prevalent inside the duct bank that runs to the crib house. This duct bank is a continuous run without manholes and the ducts are sloped toward the crib house. Site operating experience has shown that during wet seasons water collected in the ducts enters the conduit and drains into the cribhouse. As part of this aging management program, the ducts will be inspected annually to verify that the crib house end of the ducts are not plugged with debris and that water can drain from the ducts. It is indeterminate whether these cables are continuously exposed to significant moisture. The five medium-voltage cables will be tested with a proven test for detecting deterioration of the insulation system due to wetting, such as power factor, partial discharge, or polarization index, as described in EPRI TR-103834-P1-2, or other testing that is state-of-the-art at the time the test is performed. The five inaccessible medium-voltage cables covered by this aging management program are not exposed to harsh accident conditions.	No	

	XI.E3, Inaccessible Medium-Voltage Cables Not Subject To 10 CFR 50.49 Environmental Qualification Requirements	(B.1.38) Inaccessible Medium-Voltage Cables Not Subject To 10 CFR 50.49 Environmental Qualification Requirements		
Program Elements	**NUREG-1801 Description**	**Dresden-Quad Cities Basis**	**GALL Exception**	**Comments**
	this aging management program are either not exposed to harsh accident conditions or are not required to remain functional during or following an accident to which they are exposed.			
Evaluation and Technical Basis				
1.Scope of Program	This program applies to inaccessible (e.g., in conduit or direct buried) medium-voltage cables within the scope of license renewal that are exposed to significant moisture simultaneously with significant voltage. Significant moisture is defined as periodic exposures to moisture that last more than a few days (e.g., cable in standing water). Periodic exposures to moisture that last less than a few days (i.e., normal rain and drain) are not significant. Significant voltage exposure is defined as being subjected to system voltage for more than twenty-five percent of the time. The moisture and voltage exposures described as significant in these definitions, which are based on operating experience and engineering judgment, are not significant for medium-voltage cables that are designed for these conditions (e.g., continuous wetting and continuous energization is not significant for submarine cables).	The Dresden cables within the scope of this program are the five inaccessible medium-voltage cables that feed the Dresden service water pumps. These cables are routed in underground duct banks that are at times exposed to significant moisture and are energized more than twenty-five percent of the time. At Dresden, adverse conditions are expected to be prevalent inside the duct bank that runs to the crib house. This duct bank is a continuous run without manholes. The ducts are sloped toward the crib house and during wet seasons, water collected in the ducts drains into the cribhouse.	No	
2.Preventive Actions	Periodic actions are taken to prevent cables from being exposed to significant moisture, such as inspecting for water collection in cable manholes and conduit, and draining water, as needed. Medium-voltage cables for which such actions are taken are not required to be tested since operating experience indicates that prolonged exposure to moisture and voltage are required to induce this aging mechanism.	At Dresden, the duct bank is a continuous run without manholes. The ducts are sloped toward the crib house and during wet seasons water collected in the ducts drains into the cribhouse. The ducts will be inspected annually to verify that the crib house end of the ducts are not plugged with debris and that water can drain from the ducts.	No	
3.Parameters Monitored / Inspected	In-scope, medium-voltage cables exposed to significant moisture and significant voltage are tested to provide an indication of the condition of the conductor insulation. The specific type of test performed will be determined prior to the initial test, and is to be a proven test for detecting deterioration of the insulation system due to wetting, such as power factor, partial discharge, or polarization index, as described in EPRI TR-103834-P1-2, or other testing that is state-of-the-art at the time the test is performed.	It is indeterminate whether these cables are continuously exposed to significant moisture due to possible low spots in the duct run. Testing will be performed to provide an indication of the condition of the conductor insulation. The specific type of test performed will be determined prior to the initial test and is to be a proven test for detecting deterioration of the insulation system due to wetting, such as power factor, partial discharge, or polarization index, as described in EPRI TR-103834-P1-2, or other testing that is state-of-the-art at the time the test is performed.	No	
4.Detection of Aging Effects	In-scope, medium-voltage cables exposed to significant moisture and significant voltage are tested at least once every 10 years. This is an adequate period to preclude failures of the conductor insulation since experience has shown that aging degradation is a slow process. A 10-year inspection frequency will provide two data points during a 20-year period, which can be used to characterize the degradation rate. The first tests for license renewal are to be completed before the period of extended operation.	The five Dresden inaccessible medium-voltage cables exposed to significant moisture and significant voltage will be tested at least once every 10 years. The first tests for license renewal will be completed prior to the period of extended operation.	No	
5.Monitoring and Trending	Trending actions are not included as part of this program because the ability to trend test results is dependent on the specific type of test chosen. Although not a requirement, test results that are trendable provide additional information on the rate of degradation.	Trending actions are not included as part of this program because the ability to trend test results is dependent on the specific type of test chosen. Test results that are trendable may be trended to provide additional information on the rate of degradation.	No	
6.Acceptance Criteria	The acceptance criteria for each test is defined by the specific type of test performed and the specific cable tested.	The acceptance criteria for each test will be defined by the specific type of test performed on the five butyl rubber insulated inaccessible medium-voltage cables.	No	
7.Corrective Actions	An engineering evaluation is performed when the test acceptance criteria are not met in order to ensure that the intended functions of the electrical cables	The visual inspection of the crib house end of the duct run is to verify that water can drain from the end of the duct. Corrective actions will be taken to remove	No	

	XI.E3, Inaccessible Medium-Voltage Cables Not Subject To 10 CFR 50.49 Environmental Qualification Requirements	(B.1.38) Inaccessible Medium-Voltage Cables Not Subject To 10 CFR 50.49 Environmental Qualification Requirements		
Program Elements	**NUREG-1801 Description**	**Dresden-Quad Cities Basis**	**GALL Exception**	**Comments**
	can be maintained consistent with the current licensing basis. Such an evaluation is to consider the significance of the test results, the operability of the component, the reportability of the event, the extent of the concern, the potential root causes for not meeting the test acceptance criteria, the corrective actions required, and the likelihood of recurrence. When an unacceptable condition or situation is identified, a determination is made as to whether the same condition or situation is applicable to other inaccessible, in-scope, medium-voltage cables. As discussed in the appendix to this report, the staff finds the requirements of 10 CFR Part 50, Appendix B, acceptable to address corrective actions.	debris from the crib house end of the duct run. Corrective actions such as cable replacement will be implemented when test results do not meet the acceptance criteria. The requirements of 10 CFR Part 50, Appendix B, will be implemented to address corrective actions. An evaluation will be performed to consider the significance of the test results, the operability of the component, the reportability of the event, the extent of the concern, the potential root causes for not meeting the test acceptance criteria, the corrective actions required, and the likelihood of recurrence.		
8.Confirmation Process	As discussed in the appendix to this report, the staff finds the requirements of 10 CFR Part 50, Appendix B, acceptable to address the confirmation process.	The requirements of 10 CFR Part 50, Appendix B, will be implemented to address the confirmation process.	No	
9.Administrative Controls	As discussed in the appendix to this report, the staff finds the requirements of 10 CFR Part 50, Appendix B, acceptable to address the confirmation process.	The requirements of 10 CFR Part 50, Appendix B, will be implemented to address administrative controls.	No	
10.Operating Experience	Operating experience has shown that XLPE or high molecular weight polyethylene (HMWPE) insulation materials are most susceptible to water tree formation. The formation and growth of water trees varies directly with operating voltage. Treeing is much less prevalent in 4kV cables than those operated at 13 or 33kV. Also, minimizing exposure to moisture minimizes the potential for the development of water treeing. As additional operating experience is obtained, lessons learned can be used to adjust the program, as needed.	This is a new program and no plant experience exists to verify the effectiveness of this program. However, the five cables are butyl rubber insulated 4 kV cables which are less susceptible to water treeing then the XLPE or HMWPE insulation materials. A review of plant and industry experience determined that there has been no failure due to water treeing of butyl rubber cable installed in underground ducts.	No	

Conclusion:

The Dresden inaccessible medium voltage cable aging management activity is consistent with the requirements contained in GALL Section XI.E2.

Exception:
None.

Comments:
None

References:

1. EPRI TR-109619, Guideline for the Management of adverse Localized Equipment Environments, Electric power Research Institute, Palo Alto, CAQ, June 1999.
2. EPRI TR 103834-P1-2, Effects of Moisture on the Life of Power Plant Cables, Electric Power Research Institute, Palo Alto, CA, August 1994.
3. IEEE Std. P1205-2000, IEEE Guide for Assessing, Monitoring and Mitigating Aging Effects on Class 1E Equipment Used in Nuclear Power Generating Stations.
4. NUREG/CR-5643, Insights Gained From Aging Research, U.S. Nuclear Regulatory Commission, March 1992
5. SAND96-0344, Aging Management Guideline for Commercial Nuclear Power Plants – Electrical Cable and Terminations, prepared by Sandia National Laboratories for the U.S. Department of Energy, September 1996.
6. Dresden Drawing 12E-2003, Duct Runs Outdoors Area North Plan and Section.

RAI 3.6-5 Supplemental Information Request

In response to RAI 3.6-5, the applicant stated that isolated phase bus ducts do not perform any safety-related functions and are not relied upon for compliance to NRC's regulation for Fire Protection, ATWS, Station Blackout or EQ. Thus a program to address the effects discussed in RAI 3.6-4 is not required. Provide single line diagrams showing equipments involved for the SBO recovery paths.

Response

The Dresden and Quad Cities isolated phase buses are used for connecting the main generator to the main power transformer and the unit auxiliary transformer shown on boundary diagrams LR-DRE-E-2 and LR-QDC-E-2. The isolated phase bus ducts associated with the main power transformers are not utilized for SBO recovery. SBO recovery is achieved by restoring offsite power through the switchyards to the reserve auxiliary transformers.

The Dresden recovery path is shown on boundary diagram LR-DRE-E-2. Offsite power is restored to Unit 2 via the 138 KV switchyard (drawing coordinate E-9) to reserve auxiliary transformer TR-22. Offsite power is restored to Unit 3 via the 345 KV switchyard (drawing coordinate E-3) to reserve auxiliary transformer TR-32. In the event that offsite power is not available to one unit, a power source is available via a crosstie between safety related 4KV buses 23-1 and 33-1.

The Quad Cities SBO recovery path is shown on boundary diagram LR-QDC-E-2. Offsite power is restored to Unit 1 via the 345 KV switchyard (drawing coordinate B-5) to reserve auxiliary transformer TR-12. Offsite power is restored to Unit 2 via the 345 KV switchyard (drawing coordinate B-3) to reserve auxiliary transformer TR-22. In the event that offsite power is not available to one unit, a power source is available via a crosstie between safety related 4KV buses 13-1 and 23-1.

Attachment 2

Response to Request for Additional Information – Fire Protection

RAI B.1.18-01 Supplemental Information Request

NUREG-1801, XI.M26, Element 3 states that fire doors are visually inspected at least once bi-monthly for holes in the skin of the door and that clearances are also checked at least once bi-monthly as part of an inspection program. It also states that function tests of fire doors are performed daily, weekly, or monthly (plant-specific) to verify the operability of automatic hold-open, release, closing mechanisms, and latches. The Dresden and Quad Cities FP program provides for an in-depth inspection for condition and operability of fire doors once per operating cycle, which exceeds the stated frequency of NUREG-1801, XI.M26. Dresden checks fire door clearances as part of their operating cycle inspection. Quad Cities does not check door clearances as part of their operating cycle inspection, but does check fire door clearances after maintenance has been performed on a fire door. This inspection interval in excess of NUREG-1801 is justified because the fire doors most likely to experience excessive wear are those that are subject to the most frequent use. Most frequently used doors, such as those in normal and high-traffic areas, are additionally monitored by normal plant operation during periodic fire marshal tours, operator rounds, and security patrols.

The combination of in-depth inspections and monitoring by personnel performing tours, rounds and patrols has been effective in identifying degraded doors and prompting the applicant to take corrective action as necessary. Door degradation is due to wear and physical damage. No instance of door assembly loss of material due to corrosion has been identified.

The staff reviewed the applicant's response. The staff concurs that the frequency of checking doors for aging management concerns each operating cycle is adequate. However, the staff does not agree with the applicant's position that door clearances do not need to be monitored at Quad Cities as part of the inspection program.

Response

Quad Cities will include the checking of fire door clearances as a routine part of the operating cycle inspection activities. This will be implemented prior to the extended period of operation. A review was performed of the associated UFSAR supplement (A.1.18) and the aging management program description found in section B.1.18 of the license renewal application. It was determined that no changes were required as a result of this change in commitment.

RAI B.1.18-02 Supplemental Information Request

NUREG-1801, XI.M26, Element 6 states that any signs of corrosion and mechanical damage of the Halon or CO_2 fire suppression system are not acceptable. The Dresden and Quad Cities program requires that signs of aging degradation on the external surfaces of the Halon or CO_2 fire suppression systems be evaluated and corrective action be taken as required. Although this method could result in minor corrosion or mechanical damage being evaluated as acceptable, this approach provides reasonable assurance that corrective actions appropriate to the severity of the observed degradation will be implemented prior to a loss of the system or component's intended functions.

The staff reviewed the applicant's response. The response provides evaluation method or criteria for the acceptance of discovered corrosion. Without definitive criteria, the staff cannot evaluate the adequacy of the exception.

Response

The License Renewal Application, Appendix B, Section B.1.18, paragraph 5 of "Description" should have read, "The program will provide for aging management of external surfaces of Dresden and Quad Cities carbon dioxide system components and Dresden halon system components for corrosion and mechanical damage through periodic operability tests based on NFPA codes and visual inspections. Tests and inspections are implemented through predefined tasks and procedures."

Section B.1.18, second bullet under "Enhancements" should have read, "The program will provide for inspection for corrosion and mechanical damage on external surfaces of piping and components for the Dresden and Quad Cities carbon dioxide systems and the Dresden halon system."

CO_2 piping and component external surfaces are examined for indications of corrosion degradation, mechanical damage or leakage. Inspection criteria for corrosion degradation included in the inspection procedures are flaking or peeling paint (if painted), rust scale, rust stains on painted surfaces, or leakage. Inspection criteria for CO_2 leakage included in the inspection procedures include visible vapor, hissing, or surface condensation. Halon piping and component external surfaces are examined for indications of corrosion degradation, utilizing the same criteria as for CO_2, and for indications of mechanical damage.

When indications of corrosion, mechanical damage or leakage are found, work supervisors / unit supervisors are notified. Any identified indications of corrosion, mechanical damage or leakage are evaluated by Engineering to determine if corrective actions are needed. The evaluations are performed using Condition Reports, in accordance with Exelon procedures. As required, work requests are initiated to perform the work to correct the degraded or inoperable conditions.

Attachment 3

Response to Request for Additional Information – Aging Management Programs

RAI 4.7.2.3 Supplemental Information Request

Provide the flange bolt material; also, what efforts will be employed to assess age related degradation of the bolts due to galvanic corrosion associated with this TLAA?

Response

The flange bolt material is SA-193 Grade B8 Class 2 stainless steel (reference Section 4.1 of Dresden Calculation DRE97-0019 and drawing M-3230-12). Since the bolts are stainless steel, they are not susceptible to galvanic corrosion, and no efforts to assess age-related degradation due to galvanic corrosion are required.

RAI B.1.2 Supplemental Information Request

1) Provide the additional information for the corrosion performance of aluminum relative to carbon and stainless steel as outlined in the AMP B.1.2 Water Chemistry RAI response, especially in light of the statement made by the applicant that the Dresden aluminum tank bottoms have been replaced due to corrosion - what was the degradation mechanism, etc., and how will this be incorporated into inspection programs?

2) Regarding the one-time inspection for water chemistry the staff requests the applicant to provide an explanation regarding the one-time inspection of the SBLC system relative to crack initiation and SCC. The GALL report, Table VII E2, indicates that the appropriate AMP for stainless steel in SBLC is "Water Chemistry." - [Information provided during audit]

3) The staff noted that the applicant credits chemistry one-time inspections of carbon steel and stainless steel components for general, crevice and pitting corrosion. However the applicant indicated in their RAI response that they would be performing chemistry one-time inspections to detect only crevice corrosion. The staff requests the applicant to provide additional details regarding chemistry one-time inspections for detecting general corrosion and pitting corrosion.

4) The applicant's RAI response regarding Aluminum Tanks directs the staff to the Buried Piping and Tanks AMP (B.1.25). However, the RAI response to AMP B.1.25 indicates that Aluminum Tanks should have been included in Above Ground Carbon Steel Storage Tank AMP (B.1.20). The applicant needs to clarify where they intend to direct this RAI response.

Response

1) The response to RAI B.1.02, Item (h) contained the following statement:

> "Given the excellent corrosion resistance of aluminum compared to carbon and stainless steel, the Dresden and Quad Cities Water Chemistry Program will adequately manage the aging of the aluminum storage tanks by maintaining low water impurities."

Water Chemistry is credited with managing pitting and crevice corrosion for the in-scope aluminum storage tanks. Based on a review of EPRI 1003056, Non-Class 1 Mechanical Implementation Guideline and Mechanical Tools, Revision 3, Appendix A (Treated Water), there is no appreciable difference in the corrosion resistance of aluminum compared to carbon steel or stainless steel for these two aging mechanisms. Therefore, the RAI response statement identified above should have read:

> "Given the excellent corrosion resistance of aluminum, the Dresden and Quad Cities Water Chemistry Program will adequately manage the aging of the aluminum storage tanks by maintaining low water impurities."

There was no definitive aging mechanism identified for degradation of the subject Dresden aluminum tank bottoms (see response to Supplemental RAI B.1.20). The Above Ground Carbon Steel Tanks Program (see response to Supplemental RAI B.1.20) includes a requirement for performance of a one-time internal UT of the bottom of the aluminum Condensate Storage Tank or Demineralized Water Storage Tank at Quad Cities and a periodic UT thickness inspection of the bottoms of the in-scope aluminum tanks at Dresden. The Dresden UT thickness inspections will be performed at a frequency not to exceed once every 10 years. These UT inspections will identify any loss of material due to any aging mechanism for the affected tanks. The program will also include a visual internal/external inspection of the in-scope tanks at both sites for pitting and crevice corrosion at a rate not to exceed once every 5 years.

2) Section VII.E2 of NUREG-1801 addresses aging management for the Standby Liquid Control System. For stainless steel components exposed to a sodium pentaborate environment, NUREG-1801 specifies crack initiation and growth/stress corrosion cracking as the applicable aging effect/mechanism and recommends Aging Management Program XI.M2, "Water Chemistry." Unlike other instances where NUREG-1801 specifies a one-time inspection to verify the effectiveness of the chemistry control program, NUREG-1801 is silent concerning one-time inspection of SBLC components.

   When analyzing components exposed to a sodium pentaborate environment for aging management at Dresden and Quad Cities, Exelon agreed with NUREG-1801 and credited "Water Chemistry" as the appropriate aging management program. However, in Section 3.3.1.2.3 of the LRA, Exelon did take exception to the Water Chemistry program for SBLC components. Specifically, Exelon credited the SBLC make-up water chemistry rather than the chemistry of the sodium pentaborate. The technical justification provided was that the sodium pentaborate maintained in the SBLC storage tank would mask most of the chemistry parameters that need to be monitored for stress corrosion cracking. Control of the make-up water chemistry would be more effective at managing stress corrosion cracking. Exelon credited the subject one-time inspection of SBLC components in Section 3.3.1.2.3 of the LRA. This one-time inspection is to verify the effectiveness of the Water Chemistry Program at mitigating stress corrosion cracking.

3) The one-time inspections of carbon steel and stainless steel components will look for general, crevice and pitting corrosion.

The last sentence in the second paragraph of Exelon's response to RAI B.1.02, Item (g), reads:

"General corrosion is more prevalent in carbon steel; and pitting and crevice corrosion is more prevalent in stainless steel; therefore, an inspection of both types of materials will be performed."

To provide further clarity, this sentence should have read:

"General corrosion is more prevalent in carbon steel; and pitting and crevice corrosion are more prevalent in stainless steel. Both types of materials will be inspected for general, pitting and crevice corrosion."

In the bulleted paragraphs that are part of Exelon's response to RAI B.1.02, Item (g), a special focus is provided with regard to the inspection points for crevice corrosion. This special focus was provided because the focus of RAI B.1.02, Item (g) is corrosion in areas of low flow, and crevice corrosion is most likely to occur in areas of low flow. However, the special focus on inspection points for crevice corrosion was not intended to imply that the one-time inspections would look only for crevice corrosion. The one-time inspections will look for all three – general, pitting and crevice corrosion.

4) The response to RAI B.1.02, Item (h) indicated that a requirement to perform a UT of the in-scope aluminum storage tanks was included in the Dresden and Quad Cities Buried Piping and Tanks Inspection Program (AMP B.1.25). However, the subject UT is in fact to be included in the Above Ground Carbon Steel Tanks Program (AMP B.1.20).

<u>RAI B.1.20 Supplemental Information Request</u>

1) The applicant needs to address Aluminum Tanks, at a minimum, as an exception to this AMP providing sufficient information relative to the 10 elements of an AMP to evaluate the exception or create a new aging management program for these tanks.

2) Since the applicant indicated that the aluminum tank bottoms have been replaced at Dresden what inspections have been performed to date or will be performed in the future to assess the rate of degradation of these tank bottoms.

3) Provide a description of the corrosion/failure mechanism which require the aluminum tanks bottoms to be replaced.

Response

1) An acknowledgement that an exception should have been added to this section for aluminum tanks was made in the response to RAI B.1.25. The acknowledgement read as follows:

"LRA Section B.1.20, Aboveground Carbon Steel Tanks, should have referenced the UT inspection requirement for the associated above ground aluminum tanks. Since the AMP for aboveground carbon steel tanks does not include aluminum

as a material type, an exception statement to this effect should have been included in this section."

Specific information concerning the aluminum tank's portion of the Aboveground Carbon Steel Tanks program as they relate to the 10 elements is as follows:

Scope of Program:

a) As mentioned earlier, the subject tanks are aluminum and not carbon steel.
b) No protective paints/coatings are provided for the subject tanks.

Preventive Actions:

a) Sealants are provided at the interface edge between the tanks and their foundations for Dresden. A coating (Bitumastic #50) is provided between the tanks and their concrete perimeter foundations at Quad Cities. These materials prevent water and moisture penetration of the interface.
b) No protective paints/coatings are provided for other portions of the subject tanks.

Parameters Monitored/Inspected:

a) The foundation sealants/coatings for the tanks are periodically inspected as part of the Structures Monitoring Program (reference LRA Section B.1.30 and Table 3.5-2 Aging Management Reference 3.5.2.4).
b) Requirements for periodic internal/external inspections of the tanks for pitting and crevice corrosion will be in place prior to the period of extended operation at a frequency not to exceed once every five years.

Detection of Aging Effects:

a) A one-time UT inspection of the tank bottom of one of the in-scope Quad Cities aluminum tanks will be conducted prior to the period of extended operation. Neither of the remaining tanks at Quad Cities will receive similar one-time inspections unless acceptance criteria are not met for the first inspection. A periodic UT thickness inspection will be performed on the bottoms of all aluminum tanks that fall within the scope of license renewal at Dresden at a frequency not to exceed once every ten years.
b) The foundation sealants/coatings for the tanks are periodically inspected for signs of degradation. Other portions of the tanks are not provided with sealants/coatings. Therefore, no additional sealant coating inspections exist.
c) Requirements for periodic internal/external visual inspections for crevice corrosion and pitting of the tanks will be in place at both sites prior to the period of extended operation. Requirements to perform periodic UT inspections (Dresden only) will be in place prior to the period of extended operation.

Monitoring and Trending:

a) Periodic internal/external inspections of the tanks for pitting and crevice corrosion will be in place prior to the period of extended operation at a frequency not to exceed once every five years. A one-time UT wall thickness inspection of the tank bottom for one of the in-scope Quad Cities aluminum tanks will be conducted. Neither of the remaining tanks at Quad Cities will receive similar one-time inspections unless acceptance criteria are not met for the first inspection. UT wall thickness inspections will be performed on the tank bottoms of all aluminum tanks at Dresden that are included within the scope of license renewal at a frequency not to exceed once every 10 years.
b) Requirements for periodic internal/external visual inspections and UT inspections (Dresden only) of the tanks will be in place prior to the period of extended operation. The internal/external surface visual inspections will be performed at a five-year frequency rather than each outage (approximately every 2 years).

Acceptance Criteria:

a) Detection of degradation of tank sealants/coatings or evidence of corrosion and pitting will require further evaluation that may include the performance of UT thickness checks.
b) The results of the UT thickness check of the tank bottoms will be evaluated against the applicable design thicknesses and corrosion allowances.

Corrective Actions:

a) The site corrective action programs are implemented in accordance with 10CFR Part 50, Appendix B.

Confirmation Process:

a) See Corrective Actions response.

Operating Experience:

a) The tank bottoms for the subject Dresden aluminum tanks were replaced in the 1992 to 1993 timeframe. There was never any definitive aging mechanism identified by the site concerning the degradation of the subject tank bottoms.
b) The recommended enhancements to the Aboveground Carbon Steel Tanks AMP activities involving the subject aluminum tanks will be effective in managing aging degradation for the period of extended operation by providing timely detection of aging effects and implementing appropriate corrective actions prior to loss of the component intended functions.

2) The tank bottoms at Dresden have not been inspected since the tank bottoms were replaced. However, the tank bottoms will be visually inspected at a rate not to exceed once every 5 years. Additionally, UT thickness inspections of the tank bottoms will be performed at a rate not to exceed once every 10 years. Each visual inspection will, at a minimum, include a visual inspection of

internal/external surfaces for evidence of crevice corrosion or pitting. If there is evidence of crevice corrosion or pitting, an evaluation will be performed that may include a wall thickness evaluation using NDE techniques (UT). Requirements for similar visual inspections already exist for the in-scope aluminum tanks at Quad Cities. The periodic UT inspections at Dresden will ensure that tank minimum-wall requirements are maintained. The periodic visual and UT inspections will be implemented prior to the end of the current license. The periodic inspections at each site will be added to the Aboveground Carbon Steel Tanks AMP for License Renewal.

Section A.1.20 of the LRA Appendix A (for each site) is revised as follows to reflect these inspections as well information provided in the response to 1) above:

A.1.20 Aboveground Carbon Steel Tanks - Dresden

The aboveground carbon steel tanks aging management program manages corrosion of outdoor nitrogen tanks and aluminum storage tanks. Paint is a corrosion preventive measure, and periodic visual inspections monitor degradation of the paint and any resulting metal degradation. Carbon steel tanks in the scope of license renewal are above ground and not directly supported by earthen or concrete foundations. Therefore, inspection of the sealant or caulking at the tank-foundation interface, and inspection of inaccessible tank locations and on-grade tank bottoms do not apply. Aluminum storage tanks included within the scope of license renewal are supported by earthen/concrete foundations. Sealants at the tank-foundation interfaces for these tanks are periodically inspected for degradation. Periodic internal/external inspections of the aluminum tanks for pitting and crevice corrosion will be performed at a frequency not to exceed once every five years. UT wall thickness inspections will be performed on the tank bottoms of all aluminum tanks included within the scope of license renewal at a frequency not to exceed once every 10 years. Prior to the period of extended operation, the program will be revised to include documentation of results of periodic system engineer walkdowns of the nitrogen tanks and periodic visual and ultrasonic inspections of the internal/external surfaces of the aluminum storage tanks

A.1.20 Aboveground Carbon Steel Tanks – Quad Cities

The aboveground carbon steel tanks aging management program manages corrosion of outdoor nitrogen tanks and aluminum storage tanks. Paint is a corrosion preventive measure, and periodic visual inspections monitor degradation of the paint and any resulting metal degradation. Carbon steel tanks in the scope of license renewal are above ground and not directly supported by earthen or concrete foundations. Therefore, inspection of the sealant or caulking at the tank-foundation interface, and inspection of inaccessible tank locations and on-grade tank bottoms do not apply. Aluminum storage tanks within the scope of license renewal are supported by earthen/concrete foundations. The tank-foundation interfaces (including foundation coatings) are periodically inspected for degradation. Periodic visual inspections of the internal/external surfaces of the aluminum storage tanks are conducted. Prior to the period of extended

operation, the program will be revised to include documentation of results of periodic system engineer walkdowns of the nitrogen tanks, periodic visual inspections of the internal/external surfaces of aluminum tanks, and a one-time internal ultrasonic inspection of the bottom of one aluminum storage tank.

3) There was no definitive aging mechanism identified for the degradation of the subject tank bottoms.

RAI B.1.24 Supplemental Information Request

1) It is not clear to the staff how the applicant plans to deal with the potential for selective leaching under deposits in the applicant's program; provide additional detail since the proposed VT-1 inspection does not require any specific surface preparation.

2) What controls/guidance will be used for scope expansion, if necessary, as a result of initial inspections?

Response

1) ASME Section XI VT-1 inspection requirements provide the basic visual techniques for the inspection and inspector qualification criteria, but are supplemented by detailed work instructions included in the inspection work order as follows.

   a) The work instructions include background information on the nature of selective leaching, its formation, and how to recognize the existence of it.

   b) The Exelon VT Examination procedure requires surface preparation including the removal of dirt, grease or other foreign matter that would mask indication or interfere with the examination. Additionally, the work instructions for inspecting for selective leaching requires removing any evidence of selective leaching, cleaning the area down to sound metal. Sound metal is confirmed by the use of a sharpened metal probe to test for the presence of the weak, porous structure typically resulting from selective leaching. Once sound metal is achieved, additional testing/examination is required to determine remaining wall thickness.

   c) In lieu of the VT examination, an option is provided to remove the entire component from the system and sent it off-site for microscopic examination to determine the amount of degradation.

   d) The work instructions include a requirement to initiate a Condition Report to document the identification of selective leaching, with Engineering assigned accountability for evaluation and resolution.

2) The controls and guidance for scope expansion are included in the work order instructions.

   a) The components susceptible to selective leaching were identified by environment. Sampling is to start in the most aggressive environments

and if needed expand into the less aggressive environments. The environments listed below are listed in the order of most aggressive to least aggressive.

- raw water and chemically treated water
- reactor grade water and steam
- oil and fuel oil
- moist air

b) The initial sample population will consist of components susceptible to selective leaching in both raw water and chemically treated water environments.

c) Upon the determination that an inspected sample contains selective leaching to a degree that the component end-of-life would be prior to plant year 60, the inspection will be considered a failure, and the sample population will be increased.

d) Additional samples of the same material will be selected from the environment that contained the failure (raw water or chemically treated water), and additional samples from the reactor grade water and steam environment.

e) Further failures will result in additional samples being selected from the environment containing the failures and if not previously tested, the next most aggressive environment. Samples will continue to be expanded until an acceptable population is obtained, or the entire population of the environment and material has been examined.